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METHOD AND APPARATUS FOR PURIFYING INSIDE OF TEMPERING
FURNACE

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Specification

1. Title of the invention

Method and Apparatus for Purifying Inside of Tempering
Furnace

2. Claims

1. A method for purifying the inside of a tempering furnace, characterized by the fact that in a tempering furnace that heats a substance, which is to be treated and is charged into furnace, by sealing an inert gas into the furnace and heating and circulating the gas, the furnace inside is set to a high temperature; the gasification of impurities in the furnace is activated by starting vacuuming; and the inert gas in the furnace mixed with a large amount of said impure gases is changed from a high-temperature state to a low-temperature state via a cooler and discharged to the furnace outside by an exhauster.

2. An apparatus for purifying the inside of a tempering furnace, characterized by the fact that in an apparatus for purifying the inside of a furnace installed

¹ Numbers in the margin indicate pagination in the foreign text.

in a tempering furnace for heating a substance to be treated by a heating gas for circulating the furnace inside, it is equipped with an exhauster for vacuuming the furnace inside and a cooler installed in a gas passage that connects the exhauster and the above-mentioned tempering furnace.

3. Detailed explanation of the invention

(Industrial application field)

The present invention pertains to a method for purifying the inside of a tempering furnace that heats a substance, which is to be treated and is charged into furnace, by sealing an inert gas into the furnace and heating and circulating the gas.

(Prior art and its problems)

In such a tempering furnace, a substance to be treated is charged into the furnace, and the furnace inside is once vacuumed by a vacuum pump. Then, the furnace inside is substituted by an inert gas (nitrogen or argon gas) being a heat medium, and the gas is heated by a heater and circulated by a fan in the furnace, so that the substance to be treated is indirectly heated.

On the other hand, during the temperature rise in the furnace, water, oil, etc., attached or included in the wall

of the furnace, insulator, or heater are slowly evaporated, become impure gases, and lower the quality of a substance to be treated.

Here, like a furnace for a radiant heating under vacuum, in a furnace that can vacuum the furnace inside in a temperature rise process, impure gases at high temperature can be exhausted by exhausting the impure gases, however in the above-mentioned heating type /2 tempering furnace, since heating is impossible unless a gas being a heat medium exist in the furnace, impure gases cannot be exhausted. For this reason, the furnace inside is slowly oxidized by the impure gases, so that the contamination of the furnace inside and the surface oxidation of a substrate to be treated are generated.

Accordingly, before introducing a substance to be treated in advance into the furnace, the furnace inside is set to a high temperature, impure gases are actively generated by starting vacuuming, and a gas at high temperature in the furnace is exhausted, so that the furnace inside is purified. However, compared with a gas in the furnace in the case where impure gases are generated in a state in which the furnace inside is vacuumed, since the thermal capacity of the gas is much larger, if the gas is exhausted, the vacuum pump is likely to be damaged.

Therefore, in ordinary tempering furnace, impure gases having a negative influence on the tempering furnace and a substance to be treated is not exhausted in actuality, and a technique that purifies the furnace inside by exhausting a gas in the furnace containing impure gases to the furnace outside has been in demand.

(Means to solve the problems)

The method of the present invention for purifying the inside of a tempering furnace is characterized by the fact that in a tempering furnace that heats a substance, which is to be treated and is charged into furnace, by sealing an inert gas into the furnace and heating and circulating the gas, the furnace inside is set to a high temperature; the gasification of impurities in the furnace is activated by starting vacuuming; and the inert gas in the furnace mixed with a large amount of said impure gases is changed from a high-temperature state to a low-temperature state via a cooler and discharged to the furnace outside by an exhaustor.

Also, the apparatus of the present invention for purifying the inside of a tempering furnace is characterized by the fact that in an apparatus for purifying the inside of a furnace installed in a tempering furnace for heating a substance to be treated by a heating

gas for circulating the furnace inside, it is equipped with an exhauster for vacuuming the furnace inside and a cooler installed in a gas passage that connects the exhauster and the above-mentioned tempering furnace.

(Operation)

According to the above-mentioned method and apparatus for purifying the inside of a tempering furnace, first, if the furnace inside is set to a high temperature and vacuuming is started, impurities in the furnace are actively gasified. Then, an inert gas in the furnace mixed with the impure gases is changed from a high-temperature state to a low-temperature state via the cooler and exhausted to the furnace outside by the exhauster, so that the furnace inside is purified.

(Application examples)

Next, an application example of the present invention is explained referring to Figure 1.

The figure schematically shows the constitution of a tempering furnace facility equipped with the purifying apparatus of the present invention. In the figure, 1 is a tempering furnace, and a charge port 3 for charging a substance W to be treated into the tempering furnace 1 is formed at a front wall part 2. In the charge port 3, a furnace door 4 being freely opened and closed is installed.

The furnace inside is divided into front and rear spaces 6 and 7 by a partition plate 5 installed at the center. The front space 6 is used as a treatment space of the substance W to be treated, and fins 8 for forming gas flow passages are installed at the upper and lower sides of a place where the substance W to be treated is installed. In the rear space 7, a circulating fan 9 is mounted and installed at a rear wall part 10. The fan 9 is rotated by a fan motor 11 at the outside of the rear wall part 10. Also, a heater 13 fixed to a ceiling part 12 is installed in front of the fan 9. Also, in the rear space 7, a wind passage 15 for connecting the flow of the wind from the fan 9 to the front space 6 along a furnace floor part 14 is formed by a partition plate 16.

An exhaust pipe 18 in which a vacuum pump 17 for vacuuming the furnace inside is installed is connected to the tip of the furnace floor part 15, and a cooler 19 is installed in the exhaust pipe 18. The cooler 19 is a heat exchanger having a fin tube 20 and cools a passing gas in the furnace.

Next, along with the purifying action in the furnace of the facility equipped with the purifying apparatus with the above constitution, the purifying method of the present invention is explained according to the operation sequence.

(1) The furnace inside at normal temperature is vacuumed by operating the vacuum pump 17, and an inert gas such as nitrogen or argon with high purity is sealed into the furnace from a gas supply pipe not shown in the figure.

(2) A heat is generated by turning on the switch of the heater 13, the furnace inside is set to a high-temperature state by circulating a heating gas /3 by operating the fan motor 11, and the generation of impure gases is stimulated by evaporating water and oil being attached or included in the furnace inside wall, insulator, or heater. At that time, the temperature is set to a temperature slightly higher than the tempering temperature.

(3) The high-temperature state is held for a prescribed time, and the switch of the heater 13 is turned off.

(4) The generation of the impure gases is further activated by operating the vacuum pump 17, and the gas in the furnace mixed with the impure gases in a high-temperature state is exhausted to the furnace outside. At the same time, as a carrier gas, a fresh inert gas is supplied into the furnace from a gas supply pipe, and the furnace inside is slowly replaced with the fresh inert gas. When the gas passes through the cooler 19, since the gas is cooled to a low temperature and exhausted, so that the

vacuum pump 17 is not damaged. Also, in replacing the furnace inside with the inert gas, the inert gas may also be supplied after once completely vacuuming the furnace inside.

According to the above operation sequence, the impure gases are changed to a low-temperature state by the cooler 19 and exhausted to the furnace outside, so that the furnace inside is purified.

Then, even if the substance W to be treated is charged into the furnace and heated, since impure gases are not generated from the furnace inside wall, insulator, or heater, the substance to be treated is treated without being oxidized.

Figure 2 shows another application example of the present invention. In the figure, the same symbols are given to the same constitutional elements as those of the previous application example, and their explanation is omitted. This figure shows an existing tempering furnace in which a cooler 21 (having the same structure as that of the cooler 20[sic; 19] of the previous application example) is installed on the furnace floor part 14, and utilizing the cooler 21 installed, gases in the furnace are similarly exhausted.

Also, impure gases are sometimes generated from the substrate W to be treated, however in this case, after a heat treatment, the gases in the furnace are exhausted in a state in which the furnace inside is set to a high temperature, so that the impure gases can be exhausted to the furnace outside, thereby being able to purify the furnace inside.

(Effects of the invention)

According to the method and apparatus for purifying the inside of a tempering furnace, the following effects are exerted.

(1) With the installation of the cooler in the exhaust passage, since gases in the furnace in a high-temperature state can be cooled and exhausted to the furnace outside, impure gases being generated when the furnace inside is at high temperature are exhausted, so that the furnace inside can be purified.

(2) Since the furnace inside is cleanly maintained, the oxidation of the surface of a substance to be treated can be prevented.

(3) Since the oxidation of the wall of the furnace inside, heater, etc., can be prevented, the life of the furnace can be extended.

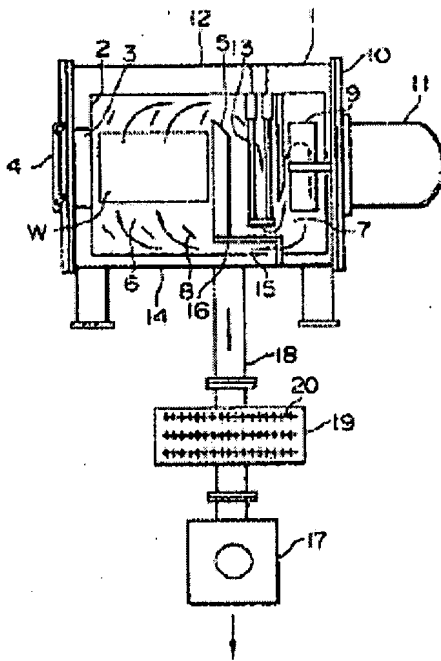
(4) Along with the life of the furnace, the maintenance interval can be extended, so that labors can be saved.

4. Brief description of the figures

Figure 1 is an outlined side view showing an application example of the present invention. Figure 2 is an outlined side view showing another application example of the present invention.

- 1 Tempering furnace
- 17 Vacuum pump (exhauster)
- 18 Exhaust pipe (passage)
- 19 Cooler

第 1 図



第 2 図

